

# The first fossil prosopistomatid mayfly from Burmese amber (Ephemeroptera; Prosopistomatidae)

**N. D. SINITSHENKOVA**

Arthropod Laboratory, Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya Str. 123, Moscow 117647, Russia

**SYNOPSIS.** An adult female of *Myanmarella rossi*, a new genus and species of mayfly is described from Burmese amber. *M. rossi* belongs to the family Prosopistomatidae and is the first fossil record of this family.

## INTRODUCTION

The Prosopistomatidae are a small, highly specialised and poorly known family of mayflies differing greatly from any other family of the order. Its phylogenetic affinities are uncertain. All living Prosopistomatidae belong to the single genus *Prosopistoma* Latreille with 15 species distributed widely but discontinuously throughout eastern hemisphere, mostly in the Oriental region (Hubbard, 1979; Pearson & Penridge, 1979; Soldán & Braasch, 1984).

The alate stages are known for three species only, *P. foliaceum* (Fourcroy), *P. africanum* Gillies (Gillies, 1954, 1956; Fontaine, 1955), and *P. pearsonorum* Campbell & Hubbard (Campbell & Hubbard, 1998); in addition the wings of an undescribed Malaysian species have been figured (Peters & Campbell, 1991). Males are represented by both imagos and subimagos while only subimagos are known for females which supposedly lack the imago stage (Gillies, 1954).

Below a fossil from Burmese amber is described and referred to a new genus and species, *Myanmarella rossi*, which constitutes the first fossil member of the family Prosopistomatidae.

Burmese amber originates from the Hukawng Valley in northern Myanmar (formerly Burma). It is probably of Upper Cretaceous age (Zherikhin & Ross, this volume). *M. rossi* is the only mayfly represented among 840 insect inclusions, which belong to 20 orders, in the Burmese amber collection kept in the Department of Palaeontology at The Natural History Museum, London.

## SYSTEMATIC DESCRIPTIONS

Order **EPHEMEROPTERA** Latreille, 1810

Superfamily **CAENOIDEA** Newman, 1853

Family **PROSOPISTOMATIDAE** Lameere, 1917

Genus **MYANMARELLA** nov.

**NAME.** After the country of origin, Myanmar.

**TYPE SPECIES.** *Myanmarella rossi* Sinitshenkova, sp. nov. Probably Upper Cretaceous, Hukawng Valley, Myanmar (Burma).

**DESCRIPTION.** Imago, female. Very small mayfly. Antennae moderately widely separated, with strongly inflated base (pedicel tumorous). Forewing 3.5 times as long as hind wing and 2.3 times as long as wide, broadly rounded at apex; RS branched, its hind branch

strongly approximated to MA<sub>1</sub>; MP<sub>2</sub> and IMP not reaching wing base, cubital area with single short intercalary vein, costal area as well as RS and M systems with very weak interrupted longitudinal veins crossing the main ones, anal veins well developed, no less than 2 in number, crossveins few, very weak; hind margin fringed with hairs. Hind wing elongate, with reduced venation, RS branched, crossvenation absent. Legs fully developed, tarsi 5-jointed. Cerci longer than body, clearly segmented, probably lacking fringe of long hairs; paracercus absent. Monobasic.

**REMARKS.** *Myanmarella* differs from living *Prosopistoma* in having the imaginal stage in female sex, the antennae longer, the wing venation less reduced, the legs fully developed, with multisegmented tarsi, the cerci long and segmented, the paracercus absent.

*Myanmarella rossi* sp. nov.

Figs 1a–g, 2

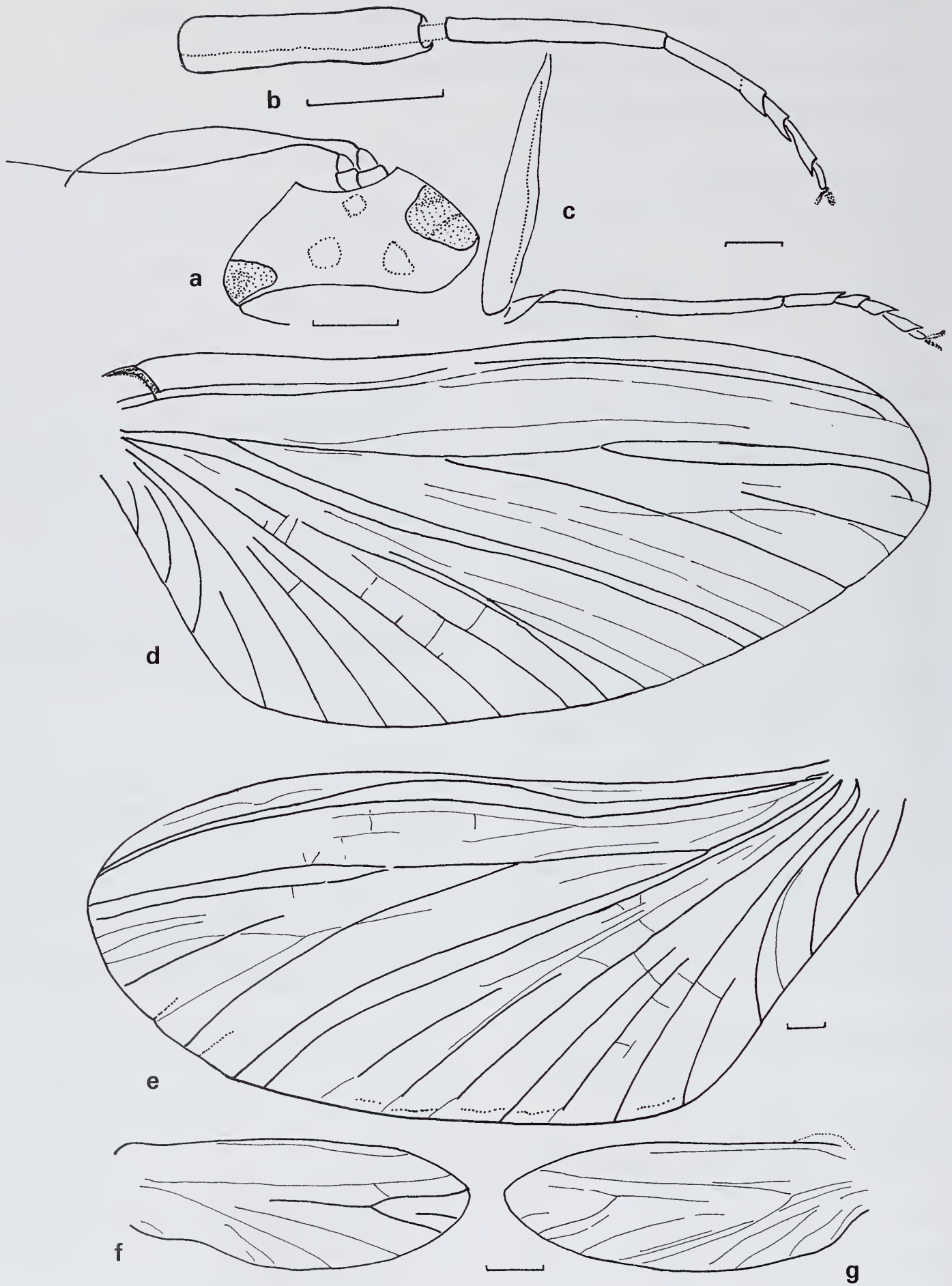
**HOLOTYPE.** NHM Palaeontology Department In.20173, a complete mayfly with outstretched wings, situated near the surface of a large piece of amber, in which several other insects are embedded: 3 Diptera (including an isolated wing of Mycetophiloidea situated over the apex of the left mayfly wing), 1 Psocoptera, and 1 Coleoptera.

**NAME.** After Mr. Andrew J. Ross, Curator of the fossil arthropods in The Natural History Museum, London.

**MATERIAL AND LOCALITY.** Holotype only, NHM Palaeontology Department In.20173, in Burmese amber; Hukawng Valley, Myanmar (Burma); probably Upper Cretaceous (see Zherikhin & Ross, this volume).

**DESCRIPTION.** Adult, female. General colour of body and wings in amber pale yellow. Eyes large, widely separated, ocelli large, round, lateral ones more visible than the front one. Antennae almost 1.5 times longer than width of head. Fore femora slightly longer than tibiae, tibia almost as long as tarsi; midfemora slightly shorter than tibiae, tarsi 1.7 times shorter than tibiae. First tarsal joint is the longest both on fore and middle legs; last joint is the shortest, second and third subequal in length, shorter than fourth. Wings transparent, without markings. Venation of right and left wing slightly different. On both forewings RS forks three times, fork of anterior branch narrow, with subparallel long branches; posterior branch of RS and MA<sub>1</sub> paired; IMP and MP<sub>2</sub> not reaching wing base; both CuA and CuP simple, CuA terminating in outer margin before tornus, intercalary vein in cubital area not reaching CuP, ending at outer margin at the level of tornus; two simple anal veins.

On the right forewing (with costal angulation rounded) the base of



**Fig. 1** *Myanmarella rossi* gen. nov. sp. nov., holotype, In.20173, Burmese amber. **a**, head, scale 0.01 mm; **b**, fore leg; **c**, middle leg; **d**, right fore wing; **e**, left fore wing; **f**, right hind wing; **g**, left hind wing; scales for 1b–1g 0.1 mm.



Fig. 2 *Myanmarella rossi* gen. nov. sp. nov., holotype, In.20173, Burmese amber. Length of right fore wing 2.25mm.

C strongly arched; R and hind branch of anterior RS fork ending in thin fold not reaching outer margin, between hind branches of RS two very weak interrupted longitudinal veins are visible; between MA and IMA two fine folds are visible, the hind one forked, between IMA and MA<sub>2</sub> one weak longitudinal vein; crossvenation restricted to basal and apical parts of wing.

On the left forewing, fore margin is crumpled at the base, in radial area a fine vein forks two times, one near wing base and another slightly proximal from wing midlength, a fine vein forks near the outer wing margin crosses IRS, between IRS and hind branch of RS no veins are visible; IMA weak, near MA a fine interrupted vein; behind CuP a fine curved vein well visible; crossvenation only at basal half of wing (about 10 veinlets). Hind wings pointed at apex, 2.8 (right) to 2.7 (left) times as long as wide, costal angulation widely rounded, longitudinal veins very fine. Venation of hind wings is also different: on the right wing one fork of RS with short intercalary well visible, base of SC not visible, subcostal area wide, R in its apical third attached by one fine crossvein, RS distally forking, MA and MP simple. On the left hind wing apex of SC is not visible, bases of R and M fused, there are several additional fine veins near main longitudinal one. Abdomen about twice as long as thorax. Cerci with long segments, the segment is three times as long as wide.

**MEASUREMENTS.** The length of fore wings: right – 2.25 mm, left – 2.15 mm, their width respectively – 0.95 mm and 0.92 mm; the length of hind wings: right – 0.65 mm, left – 0.62 mm.

**DISCUSSION.** The nymphs of living Prosopistomatidae inhabit exclusively running waters where they occur mostly on the underside of stones in rapid flows (Gillies, 1954; Peters, 1967; Alouf, 1977; Soldan & Braasch, 1984; Koch, 1988); as a rule they occur in rather small streams though the European *Prosopistoma foliaceum* is found mainly in large rivers such as the Rhone, Rhein, and Vltava (Lafon, 1952). The winged stages are extremely short-lived, with the life-span possibly less than an hour (Gillies, 1954). Both the nymphs and adults have a very poor preservation potential as fossils. The winged insects are very delicate, and after death their bodies rapidly become dried up and shrivelled so that even freshly collected specimens can not be studied accurately without special care (Gillies, 1954). Thus it is not surprising that no fossil prosopistomatids were known up until now.

*Myanmarella* is placed in this family because of its peculiar wing

venation with weak additional longitudinal veins and few crossveins and especially because of its long antennae with the strongly enlarged pedicel. These features are unique synapomorphies of Prosopistomatidae not occurring in any other mayfly family. In living species, the peculiar shape of the antennae occurs in male imagos only (females have this feature less expressed); most probably, this is not sexual dimorphism but a character lost in modern *Prosopistoma* females because of lacking an imago stage.

*Myanmarella* is clearly less advanced than recent *Prosopistoma*, as indicated by its less reduced wing venation and especially by the fully developed legs with 5-segmented tarsi. In *Prosopistoma*, the male imagos have short but functional legs with 3-segmented tarsi while in the females the legs are extremely reduced and non-functional. The long and clearly segmented cerci of *Myanmarella* are also plesiomorphous in comparison to shorter (even in the male imago) ones of *Prosopistoma*. On the other hand, *Myanmarella* is autapomorphous in a complete reduction of the paracercus which is as long as the cerci in *Prosopistoma*. Thus, *Myanmarella* represents rather an extinct sister lineage to *Prosopistoma* than the ancestral stock of the family.

The family Prosopistomatidae was placed by different authors either near Baitiscidae (Gillies, 1954), Oligoneuriidae and Tricorythidae (Degrange, 1955; Demoulin, 1955). In the recent phylogenetic system of the order (McCafferty, 1991) it is included in the superfamily Caenoidea and separated from Baetiscoidea. *Myanmarella* is already a highly advanced genus which does not clarify the disputable phylogenetic relations of the family. It is possible only to say with certainty, that the wing venation of *Myanmarella* indicates no similarity with that of Baetiscoidea except for the reduction in number of the anal veins to two. This state occurs in different mayfly lineages and should be of little phylogenetic importance.

Biologically *Myanmarella* was probably similar to *Prosopistoma* except for having more long-living winged females that reached the imago stage. The functional legs should have allowed them to rest on vegetation; *Prosopistoma* females cannot rest on a substrate and spend all of their short life in flight.

**ACKNOWLEDGEMENTS.** I extend my appreciation to Mr. Andrew J. Ross, curator of the fossil arthropods in the Natural History Museum in London for passing me such an exciting specimen of mayfly. I especially thank Prof. William L. Peters, Florida A & M University, Tallahassee, Dr. John. E. Brittain, University of Oslo, for sending me the copies of necessary articles, and Dr. Vladimir V. Zherikhin, Paleontological Institute of the Russian Academy of Sciences, Moscow, Russia, for the criticism of the manuscript. I also thank Mr Peter York (NHM) for photographing the specimen.

## REFERENCES

- Alouf, N. J. 1977. Sur la présence du genre *Prosopistoma* au Liban. Description de *P. oronti* n. sp. et de *P. phoenicium* n. sp. (Ephemeroptera). *Annals of Limnology*, **13** (2): 133–139.
- Campbell, I.C. & Hubbard, M.D. 1998. A new species of *Prosopistoma* (Ephemeroptera: Prosopistomatidae) from Australia. *Aquatic Insects*, **20** (3): 141–148.
- Degrange, C. 1955. Sur la morphologie de *Prosopistoma foliaceum* Fourcroy. *Compte Rendus de l'Academie de Science, Paris*, **240**: 1668–69.
- Demoulin, G. 1955. A propos des affinités systématiques des Prosopistomatidae (Ephemeroptera). *Bulletin et Annales de la Société Royale d'Entomologie de Belgique*, **7–8**: 209–213.
- Fontaine, J. 1955. Les formes ailées de *Prosopistoma foliaceum* Fourcroy (Ephemeroptera). *Bulletin de la Société Liméenne de Lyon*, **24**: 60–65.
- Gillies, M. T. 1954. The adult stages of *Prosopistoma* Latreille (Ephemeroptera), with

- descriptions of two new species from Africa. *Transactions of the Royal Entomological Society of London*, **105**: 355–372.
- 1956. A supplementary note on *Prosopistoma* Latreille (Ephemeroptera). *Proceedings of the Royal Entomological Society of London*, **31**: 165–166.
- Hubbard, M. D.** 1979. A nomenclatural problem in Ephemeroptera: *Prosopistoma* or *Binoculus*? *Proceedings of the 2nd International Conference on Ephemeroptera*, 1975, Krakow: 73–77.
- Koch, S.** 1988. Mayflies of the Northern Levant (Insecta: Ephemeroptera). *Zoology in the Middle East* 2, Insecta: 89–112.
- Lafon, J.** 1952. Note sur *Prosopistoma foliaceum* Fourc. (Ephéméroptères). *Bulletin de la Société Zoologique de France*, **77**: 425–436.
- McCafferty, W. P.** 1991. A phylogenetic classification of the Ephemeroptera (Insecta); a commentary on systematics. *Annals of the Entomological Society of America*, **84** (4): 343–360.
- Pearson, R. G. & Penridge, L. K.** 1979. First record of *Prosopistoma sedlaceki* in Australia (Ephemeroptera: Prosopistomatidae). *Journal of the Australian Entomological Society*, **18**: 362.
- Peters, W. L.** 1967. New species of *Prosopistoma* from the Oriental Region (Prosopistomatoidea: Ephemeroptera). *Tijdschrift voor Entomologie*, **110**: 207–222.
- & **Campbell I. C.** 1991. Ephemeroptera (Mayflies). In: *The insects of Australia*, 2nd edition, **1**: 279–293. Melbourne University Press.
- Poinar, G.** 1992. *Life in amber*. Stanford University Press, Stanford. 350 pp.
- Rasnitsyn, A. P.** 1996. Burmese amber in the Natural History Museum. *Inclusion (WrosteK)*, **23**: 19–21.
- Soldán, T. & Braasch, D.** 1984. Two new species of the genus *Prosopistoma* (Ephemeroptera, Prosopistomatidae) from Vietnam. *Acta Entomologica Bohemoslovaca*, **81**: 370–376.
- Zherikhin, V. V.** 1978. Rasvitye i smena melovykh i kaynozoykskikh faunisticheskikh kompleksov. *Trudy Paleontologicheskogo Instituta*, **165**: 198 pp.